

U.S. DEPARTMENT OF COMMERCE, PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER
33808F170

U.S. APPLICATION NO (if known,
see 37 CFR 1.55)
10/070555

INTERNATIONAL APPLICATION NO
PCT/FR00/02441

INTERNATIONAL FILING DATE
September 5, 2000

PRIORITY DATE CLAIMED
September 10, 1999

TITLE OF INVENTION
APPLICANT(S) FOR DO/EO/US

CROSSLINKABLE COMPOSITIONS FORMED FROM FUNCTIONALIZED POLYOLEFIN POWDERS
Patrice Robert, et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(l).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau) (see below 16e).
 - b. ☒ has been transmitted by the International Bureau (see accompanying PCT Form 308).
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 34 (35 U.S.C. 371).
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made, however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 34 (35 U.S.C. 371).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
 - ☐ A SECOND or SUBSEQUENT preliminary amendment
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter
16. ☒ Other items or information
 - a. PCT Publication WO 01/19911 with International Search Report (PCT/ISA/210)
 - b. PCT Request (Form PCT/RO/101)
 - c. Notice Informing the Applicant of the Communication of the International Application to the Designated Offices (PCT/IB/308)
 - d. Form PCT/ISA/220 (in French)
 - e. International Search Report (Form PCT/ISA/210 (in French))
 - f. Form PCT/IB/332 (in French)
 - g. International Preliminary Examination Report (Form PCT/IPEA/409 and PCT/IPEA/416) (in French)
 - h.

2018 Rec'd PCT/PTO 08 MAR 2002

ATTORNEY'S DOCKET NUMBER
33808F170TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371U.S. APPLICATION NO (if known, see
37 CFR 1.5)

10/070555

17. ☒ The following fees are submitted

CALCULATIONS PTO USE ONLY

Basic National Fee (37 CFR 1.492(a)(1)-(5)):

Search Report has been prepared by the EPO or JPO \$890.00

International preliminary examination fee paid to USPTO
(37 CFR 1.482) \$710.00No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee
paid to USPTO (37 CFR 1.445(a)(2)) \$740.00Neither international preliminary examination fee (37 CFR 1.482) nor
international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$1,040.00International preliminary examination fee paid to USPTO (37 CFR 1.482)
and all claims satisfied provisions of PCT Article 33(2)-(4) \$100.00**ENTER APPROPRIATE BASIC FEE AMOUNT =**

\$890.00

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed
priority date (37 CFR 1.495(e)).

\$ ---

Claims	Number Filed	Number Extra	Rate		
Total Claims	7 - 20 =	0	x \$18.00		
Independent Claims	1 - 3 =	0	x \$84.00		
Multiple dependent claim(s) (if applicable)			+ \$280.00		

TOTAL OF ABOVE CALCULATIONS =

\$ 890.00

Reduction by 1/2 for filing by small entity, if applicable Verified Small Entity statement must also be filed. (Note
37 CFR 1.9, 1.27, 1.28)**SUBTOTAL =**

\$ 890.00

Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest
claimed priority date (37 CFR 1.492(f))

+

TOTAL NATIONAL FEE =

.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)) The assignment must be accompanied by an
appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property

+

TOTAL FEES ENCLOSED =

\$890.00

Amount to be
refunded \$

charged \$

a. ☒ A check in the amount of \$ 890.00 to cover the above fees is enclosedb. ☐ Please charge my Deposit Account No _____ in the amount of \$ _____ to cover the above fees.c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No 02-4300**NOTE:** Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and
granted to restore the application to pending status.**SEND ALL CORRESPONDENCE TO:**SMITH, GAMBRELL & RUSSELL, LLP
1850 M Street, N.W., Suite 800
Washington, D.C. 20036
Telephone: (202) 659-2811
Facsimile: (202) 263-4329

SIGNATURE

Frederick F. Calvetti 28,557
NAME REGISTRATION NO.

Date: March 8, 2002

Atty. Dkt. No.
33808F170

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Patrice Robert, et al.

International No. PCT/FR00/02441

International Filing Date: September 5, 2000

U.S. Serial No.: To Be Assigned

Group Art Unit: To Be Assigned

Filed: : Herewith

Examiner: To Be Assigned

For : **CROSSLINKABLE COMPOSITIONS FORMED FROM**
: **FUNCTIONALIZED POLYOLEFIN POWDERS**

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, DC 20231

Sir:

Prior to or concurrent with calculation of the filing fees, please amend this application as follows.

IN THE SPECIFICATION:

On page 1, please delete the paragraph heading "[The technical problem]"

On page 1, line 25, please add the paragraph heading "Background of the Invention";

On page 2, line 11, please delete the paragraph heading "[The prior art]"

Applicants have attached to this Amendment a document entitled "Amended Specification."

Please insert the indicated paragraph at the end of the present specification (page 20).

IN THE CLAIMS:

Applicants have attached to this Amendment documents entitled "Amended Claims" and "Marked-Up Copy of Previous Claims". Please replace claims 2-7 with amended claims 2-7 as shown in the document entitled "Amended Claims".

CONFIDENTIAL

REMARKS

Entry and consideration of this Preliminary Amendment are respectfully requested prior to or concurrent with calculation of the filing fees. This Preliminary Amendment is being filed to correct multiple dependency claims and to avoid the multiple dependency fee. As so amended, the claims are submitted as appearing in proper form.

Examination on the merits is awaited.

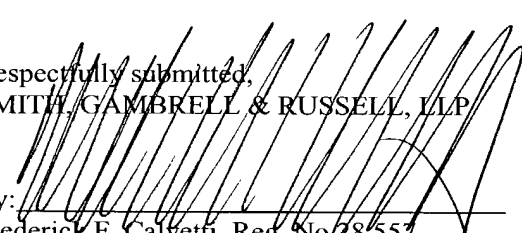
AUTHORIZATION

No additional fee is believed to be necessary.

The Commissioner is hereby authorized to charge any additional fees, which may be required for this amendment, or credit any overpayment to Deposit Account No. 02-4300, Order No. 33808.163.

In the event that an extension of time is required, or which may be required in addition to that requested in a petition for an extension of time, the Commissioner is requested to grant a petition for that extension of time which is required to make this response timely and is hereby authorized to charge any fee for such an extension of time or credit any overpayment for an extension of time to Deposit Account No. 02-4300, Order No. 33808.170.

Respectfully submitted,
SMITH, GAMBRELL & RUSSELL, LLP

By: 
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March 8, 2002

AMENDED CLAIMS



2. The composition as claimed in claim 1, wherein (A) is selected from copolymers of ethylene and an unsaturated carboxylic acid anhydride and (B) is selected from copolymers of ethylene and an unsaturated epoxide.

3. The composition as claimed in claim 2, wherein (A) is selected from ethylene/alkyl (meth) acrylate/maleic anhydride copolymers, these copolymers comprising from 0.2 to 10% by weight of maleic anhydride and from 5 to 40% by weight of alkyl (meth) acrylate.

4. The composition as claimed in claim 2, wherein the product (B) is advantageously an ethylene/alkyl (meth) acrylate/unsaturated epoxide copolymer which can contain up to 40% by weight of alkyl (meth) acrylate and up to 10% by weight of unsaturated epoxide.

5. The composition as claimed in claim 1, wherein (A) is selected from copolymers of ethylene and an unsaturated carboxylic acid anhydride and (B) is selected from polyamines adsorbed on a zeolite.

6. The composition as claimed in claim 1, wherein (A) is selected from copolymers of ethylene and an unsaturated epoxide and (B) is selected from polyamines adsorbed on a zeolite.

7. A process for the manufacture of an item molded by slush molding comprising the melting of a composition according to claim 1, followed by crosslinking of the latter.

AMENDED SPECIFICATION

Although the invention has been described in conjunction with specific embodiments, it is evident that many alternatives and variations will be apparent to those skilled in the art in light of the foregoing description. Accordingly, the invention is intended to embrace all of the alternatives and variations that fall within the spirit and scope of the appended claims. The foregoing references are hereby incorporated by reference.

MARKED UP COPY OF CLAIMS

2. The composition as claimed in claim 1, [in which] wherein (A) is [chosen] selected from copolymers of ethylene and an unsaturated carboxylic acid anhydride and (B) is [chosen] selected from copolymers of ethylene and an unsaturated epoxide.

3. The composition as claimed in claim 2, [in which] wherein (A) is [chosen] selected from ethylene/alkyl (meth) acrylate/maleic anhydride copolymers, these copolymers comprising from 0.2 to 10% by weight of maleic anhydride and from 5 to 40% by weight of alkyl (meth) acrylate.

4. The composition as claimed in claim 2 [or 3], wherein [in which] the product (B) is advantageously an ethylene/alkyl (meth) acrylate/unsaturated epoxide copolymer which can contain up to 40% by weight of alkyl (meth) acrylate and up to 10% by weight of unsaturated epoxide.

5. The composition as claimed in claim 1, [in which] wherein (A) is [chosen] selected from copolymers of ethylene and an unsaturated carboxylic acid anhydride and (B) is [chosen] selected from polyamines adsorbed on a zeolite.

6. The composition as claimed in claim 1, [in which] wherein (A) is [chosen] selected from copolymers of ethylene and an unsaturated epoxide and (B) is [chosen] selected from polyamines adsorbed on a zeolite.

7. A process for the manufacture of an item molded by slush molding comprising the melting of a composition according to [any one of the preceding claims] claim 1, followed by [the] crosslinking of the latter.

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PCT/FR00/02441

CROSSLINKABLE COMPOSITIONS FORMED FROM FUNCTIONALIZED
POLYOLEFIN POWDERS

[Field of the invention]

5

The present invention relates to crosslinkable compositions formed from functionalized polyolefin powders which can be used in the slush molding process or in the thermoforming of sheets or in injection molding over an
10 insert and more particularly to compositions based on functionalized polyethylene.

PVC or polyolefin powders are used to obtain skins by the process of molding by the free flow of powder onto a hot mold (hereinafter called the slush molding
15 process). Slush molding is used for the manufacture of skins for dashboards, door panels and consoles in the automobile field. The powder is brought into contact with the hot mold, for example by the free flow technique - the powder forms a skin by melting. These skins have a very
20 soft feel and do not have residual stresses, which makes it possible, during the aging of the skin, to avoid the risk of the appearance of cracks caused by residual stresses relaxing.

25 [The technical problem]

Automobile dashboards are very often made of

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polyurethane and covered with a PVC skin obtained by the slush molding process. It is becoming less possible to use PVC because of the risk of pollution caused by its combustion. It is therefore necessary to develop polyolefin
5 skins. Polypropylene skins have already been disclosed in the prior art but these skins are not sufficiently resistant to the high temperatures which can be found in automobiles out in the sun and with closed windows - this resistance is measured by the hot creep.

10

[The prior art]

Patent FR 2,721,319 discloses powder compositions for slush molding based on polypropylene and on ethylene-
15 propylene rubber (EPR). The skins obtained do not have good creep resistance.

[Brief description of the invention]

20

Polyolefin powder compositions have now been found which can be used in slush molding, in the thermoforming of sheets or in injection molding over an insert and which are crosslinkable thus, abrasion resistance and good creep resistance are obtained. The
25 present invention is thus a crosslinkable composition formed from functionalized polyolefin powder comprising:

- a functionalized polyolefin (A) having an MFI of at least 20 (190°C/2.16 kg) containing an anhydride and/or

epoxy functional group,

- a product (B) having the role of crosslinking (A),
- the composition having a particle size between 100 and 400 μm .

5 According to a first embodiment of the invention, (A) is chosen from copolymers of ethylene and an unsaturated carboxylic acid anhydride and (B) is chosen from copolymers of ethylene and an unsaturated epoxide.

 According to a second embodiment of the
10 invention, (A) is chosen from copolymers of ethylene and an unsaturated carboxylic acid anhydride and (B) is chosen from polyamines adsorbed on a zeolite.

 According to a third embodiment of the invention, (A) is chosen from copolymers of ethylene and an
15 unsaturated epoxide and (B) is chosen from polyamines adsorbed on a zeolite.

 In the slush molding process, the composition of the invention is converted into a skin on contact with the mold. The crosslinking takes place at a higher temperature
20 than the melting point of (A) when it is carried out while the skin is in the mold, such as, for example, in the three embodiments mentioned above. The crosslinking takes place at a temperature between room temperature and the softening point of (A) when this crosslinking is initiated
25 subsequently by a process of moisture diffusion through the skin, such as, for example, in the second and third embodiment, if it is chosen to allow the moisture to drive the amine from the zeolite after formation of the skin.

[Detailed description of the invention]

As regards the first embodiment, the copolymers
5 (A) can be polyethylenes grafted with an unsaturated
carboxylic acid anhydride or copolymers of ethylene and an
unsaturated carboxylic acid anhydride which are obtained,
for example, by radical polymerization.

The unsaturated carboxylic acid anhydride can be
10 chosen, for example, from maleic, itaconic, citraconic,
allylsuccinic, cyclohex-4-ene-1,2-dicarboxylic, 4-methyl-
enecyclohex-4-ene-1,2-dicarboxylic, bicyclo[2.2.1]hept-5-
ene-2,3-dicarboxylic and x-methylbicyclo[2.2.1]hept-5-ene-
2,2-dicarboxylic anhydrides. Maleic anhydride is
15 advantageously used. It would not be departing from the
scope of the invention to replace all or part of the
anhydride with an unsaturated carboxylic acid, such as, for
example, (meth)acrylic acid.

As regards the polyethylenes onto which the
20 unsaturated carboxylic acid anhydride is grafted,
« polyethylene » is understood to mean homo- or copolymers.

Mention may be made, as comonomers, of:

- α -olefins, advantageously those having from 3 to
30 carbon atoms; mention may be made, as examples of
25 α -olefins, of propylene, 1-butene, 1-pentene, 3-methyl-1-
butene, 1-hexene, 4-methyl-1-pentene, 3-methyl-1-pentene,
1-octene, 1-decene, 1-dodecene, 1-tetradecene,
1-hexadecene, 1-octadecene, 1-eicosene, 1-docosene,

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1-tetracosene, 1-hexacosene, 1-octacosene and
1-triacontene; these α -olefins can be used alone or as a
mixture of two or of more than two,

- unsaturated carboxylic acid esters, such as, for
5 example, alkyl (meth)acrylates, it being possible for the
alkyls to have up to 24 carbon atoms; examples of alkyl
acrylate or methacrylate are in particular methyl
methacrylate, ethyl acrylate, n-butyl acrylate, isobutyl
acrylate or 2-ethylhexyl acrylate,

10 - vinyl esters of saturated carboxylic acids, such
as, for example, vinyl acetate or propionate,

- dienes, such as, for example, 1,4-hexadiene,

- the polyethylene can comprise several of the above
comonomers.

15 The polyethylene, which can be a blend of several
polymers, advantageously comprises at least 50% and
preferably 75% (as moles) of ethylene and its density can
be between 0.86 and 0.98 g/cm³. The MFI (viscosity index at
190°C/2.16 kg) is advantageously between 20 and 1000 g/
20 10 min.

Mention may be made, as examples of
polyethylenes, of:

- low-density polyethylene (LDPE)
- high-density polyethylene (HDPE)
- 25 - linear low-density polyethylene (LLDPE)
- very low-density polyethylene (VLDPE)
- polyethylene obtained by metallocene catalysis,
that is to say polymers obtained by copolymerization of

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ethylene and an α -olefin, such as propylene, butene, hexene or octene, in the presence of a single-site catalyst generally composed of a zirconium or titanium atom and of two cyclic alkyl molecules bonded to the metal. More specifically, the metallocene catalysts are usually composed of two cyclopentadiene rings bonded to the metal. These catalysts are frequently used with aluminoxanes as cocatalysts or activators, preferably methylaluminoxane (MAO). Hafnium can also be used as metal to which the cyclopentadiene is attached. Other metallocenes may include transition metals from Groups IVA, VA and VIA. Metals from the lanthanide series can also be used.

- EPR (ethylene-propylene rubber) elastomers
- EPDM (ethylene-propylene-diene) elastomers
- blends of polyethylene with an EPR or an EPDM
- ethylene/alkyl (meth)acrylate copolymers possibly containing up to 60% by weight of (meth)acrylate and preferably 2 to 40%.

The grafting is an operation known per se.

As regards the copolymers of ethylene and an unsaturated carboxylic acid anhydride, that is to say those in which the unsaturated carboxylic acid anhydride is not grafted, these are copolymers of ethylene, an unsaturated carboxylic acid anhydride and optionally another monomer which can be chosen from the comonomers that were mentioned above in the case of the ethylene copolymers intended to be grafted.

Use is advantageously made of ethylene/maleic

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anhydride and ethylene/alkyl (meth)acrylate/maleic anhydride copolymers. These copolymers comprise from 0.2 to 10% by weight of maleic anhydride and from 0 to 40% and preferably 5 to 40% by weight of alkyl (meth)acrylate.

5 Their MFI is between 20 and 100 (190°C/2.16 kg). The alkyl (meth)acrylates have already been described above. The melting point is between 80 and 120°C.

The copolymer (A) is commercially available - it is produced by radical polymerization at a pressure which
10 can be between 200 and 2500 bar. It is sold in the form of granules. It can be powdered by microgranulation, for example by using the underwater cutting technique of the company Gala (Virginia, USA) or by cryogenic grinding.

As regards (B), the copolymers of ethylene and of
15 an unsaturated epoxide, these can be obtained by copolymerization of ethylene and of an unsaturated epoxide or by grafting the unsaturated epoxide onto the polyethylene. The grafting can be carried out in the solvent phase or onto the molten polyethylene in the
20 presence of a peroxide. These grafting techniques are known per se. Regarding the copolymerization of ethylene and of an unsaturated epoxide, use may be made of the processes referred to as radical polymerization processes which usually operate at pressures between 200 and 2500 bar.

25 Mention may be made, as examples of unsaturated epoxides, of:

- aliphatic glycidyl esters and ethers, such as allyl glycidyl ether, vinyl glycidyl ether, glycidyl

- alicyclic glycidyl esters and ethers, such as 2-cyclohexene-1-glycidyl ether, diglycidyl cyclohexene-4,5-carboxylate, glycidyl cyclohexene-4-carboxylate, glycidyl 5-norbornene-2-methyl-2-carboxylate and diglycidyl endo-cis-bicyclo[2.2.1]hept-5-ene-2,3-dicarboxylate.

15 The product (B) is advantageously an
ethylene/alkyl (meth)acrylate/unsaturated epoxide
copolymer. It may advantageously contain up to 40% by
weight of alkyl (meth)acrylate, preferably 5 to 40%, and up
to 10% by weight of unsaturated epoxide, preferably 0.1 to
20 8%.

The alkyl (meth)acrylate is advantageously chosen from methyl (méth)acrylate, ethyl acrylate, n-butyl acrylate, isobutyl acrylate or 2-ethylhexyl acrylate. The amount of alkyl (meth)acrylate is advantageously from 20 to 35%. The MFI is advantageously between 5 and 100 (in g/10 min at 190°C/2.16 kg) and the melting point is between

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60 and 110°C. This copolymer can be obtained by radical polymerization of the monomers. The process for forming a powdering is carried out as for (A).

It would not be departing from the scope of the invention if the composition were to comprise several polymers (A) and/or several polymers (B). (This applies to all the embodiments).

As regards the proportions of (A) and (B), these are advantageously such that there are 0.1 to 1.5 (preferably 0.2 to 0.6) anhydride functional groups per epoxide functional group. It is advantageous to use a catalyst, that is to say a product capable of accelerating the reaction between the anhydride functional groups and the epoxide functional groups. This catalyst acts right from the melting of (A) and (B) which have to be similar. The proportion of catalyst is easily determined by a person skilled in the art, these reactions between anhydride and epoxide functional groups being known per se. The crosslinking is advantageously carried out by heating the mold at a temperature above the melting point of (A).

Mention may in particular be made, among the compounds capable of accelerating the reaction between the epoxy functional group present in (B) and the anhydride functional group present in (A), of:

- tertiary amines, such as dimethyl-laurylamine, dimethyl-stearylamine, N-butylmorpholine, N,N-dimethyl-cyclohexylamine, benzyldimethylamine, pyridine, 4-dimethyl-aminopyridine, 1-methylimidazole, tetramethylethyl-

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hydrazine, N,N'-dimethylpiperazine, N,N,N',N'-tetramethyl-1,6-hexanediamine or a mixture of tertiary amines having from 16 to 18 carbon atoms and known under the name of dimethyltallowamine,

- 5 - tertiary phosphines, such as triphenylphosphine,
- zinc alkyl dithiocarbamates,
- acids, such as polymers like LUCALIN (an ethylene/butyl acrylate/acrylic acid terpolymer),
- magnesium salts such as mixtures containing 65%
- 10 stearate salt and 35% palmitate salt.

As regards the second embodiment of the invention, the functionalized polyethylene (A) has already been described in the first embodiment. (B) is a polyamine adsorbed on a zeolite - under the effect of a temperature

15 rise, the polyamine is desorbed and crosslinks (A). It is sufficient to choose a polyamine/zeolite pair such that the desorption takes place at least at the melting point of (A). The desorption is also brought about by water or moisture, which it is why it is recommended to add, to the

20 zeolite charged with polyamine, another zeolite capable of adsorbing the moisture in order to prevent crosslinking during storage. This technique for crosslinking a polymer comprising carboxylic acid anhydride groups with zeolites which release polyamines under the effect of the

25 temperature or of the moisture has been disclosed in patent US 5,792,816, the contents of which are incorporated in the present application.

Mention may be made, as examples of polyamine,

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of: ethylenediamine, propanediamine, butanediamine, pentanediamine, hexanediamine, the isomers of the preceding amines, 1,2-diaminocyclohexane, 1,4-diaminocyclohexane, diethylenetriamine, triethylenetetramine, tetraethylene-
 5 pentamine, 3-[(N-aminoethyl)amino]propyltrialkoxysilane, triaminopropyltrialkoxysilane, piperazine, aminoethyl-piperazine, diaminoethylpiperazine, xylylenediamine, isophoronediamine, 3,3'-dimethyl-4,4'-diaminocyclohexylmethane or 1,4-diaminobenzanilide. A portion of the
 10 polyamine can be replaced with polyols or aminoalcohols, such as, for example: ethylene glycol, propylene glycol, triethylene glycol, dipropylene glycol, butanediol, neopentyl glycol, cyclohexane-dimethanol, hydroquinone bishydroxyl ether, triethanolamine, methyldiethanolamine,
 15 tripropanolamine, N,N-di(2-hydroxyethyl)aniline, ethanolamine, diethanolamine, propanolamine, dipropanolamine and N-(hydroxyethyl)aniline. Regarding the zeolites, use is advantageously made of those having pore diameters between 0.3 and 1.5 nm and preferably of a zeolite chosen from the
 20 following four (the pore diameter is shown):

- 0.38 nm, designated as type 4A,
- 0.44 nm, designated as type 5A,
- 0.8 nm, designated as type 10X,
- 0.84 nm, designated as type 13X.

25 All these zeolites are available with a particle size of the order of 20 to 50 μ m. The zeolite can, in addition to the polyamine, be charged with a catalyst for the reaction of the anhydride and the amine. Various examples of

desorption temperatures are given below:

Zeolite	Amine	Desorption temperature (°C)
4A	Ethylenediamine	175 +/- 5
4A	Ethanolamine	175 +/- 5
13X	Ethylenediamine	130 +/- 5
13X	Ethanolamine	125 +/- 5
13X	Diethylenetriamine	125 +/- 5
13X	Piperazine	120 +/- 5

Once the skin has formed, the crosslinking can be
 5 carried out by heating beyond the melting point of (A) or
 subsequently, the skin having been removed from the mold,
 by diffusion of the ambient moisture at a temperature of
 between room temperature and the softening point of (A).

As regards the third embodiment of the invention,
 10 this is of the same type as the second embodiment but the
 copolymer of ethylene and of a carboxylic acid anhydride is
 replaced with a copolymer of ethylene and of an epoxide.
 Such a copolymer has already been described as polymer (B)
 in the first embodiment. It is sufficient only for it to
 15 have an MFI of at least 20.

The grafting reaction is carried out in a single-
 screw or twin-screw extruder fed with polyolefins from a
 feed hopper, for example in the form of granules. The

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polyolefins are melted by heating in a first zone of the extruder and the reactants are introduced into the melt of the polyolefins in a second zone.

The radical initiators may be chosen from
5 peroxides, peracids, peresters and peracetals. In general, they are used in an amount from 0.01% to 0.5% by mass with respect to the polyolefins to be grafted.

The compositions of the invention may also include anti-caking agents such as the silica AEROSIL R972,
10 processing aids such as ethylene bis(stearamide), mold release agents, such as calcium stearate or magnesium stearate, and other ingredients, such as tackifying resins, such as the resin REGALITE R1115.

They may also include processing stabilizers such
15 as IRGAFOS 168, DDPP, P-EPQ, TNPP, TPP, PS 800 and PS 802, antioxidants, such as IRGANOX 1010, 245, 259, 565, 1035, 1076, 1098, 1135, 1141, 1330, 1425, 3052, 3114, 5057 and M1024, mixtures of antioxidants and processing stabilizers, such as IRGANOX B225, and UV stabilizers, such
20 as the TINUVIN and CHIMASSORB range from Ciba.

They may also include fillers and coloring pigments, such as carbon black and TiO₂.

They may also include deodorizing agents, such as active carbon: for example 3S, CXV (CECA), undecylenic
25 acid, ethyl undecylenate, calcium undecylenate, zinc undecylenate cyclodextrin, zeolites, such as FLAVITH, and fragrances.

After the skin has been formed by melting the

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powder blend (A)+(B) on the hot mold, excess unmelted powder is removed and then the crosslinking can be continued or initiated by placing the skin in an oven at a temperature of between 200 and 350°C for a time of between 5 10 s and 10 min. The skin is subsequently separated from the mold after cooling. It is also possible, in the second and third embodiment, to remove the skin from the mold and then crosslink it with moisture.

The compositions of the invention make it 10 possible to obtain skins which have a very soft touch, which have a Shore A hardness of less than 90 without the use of liquid plasticizers, and which do not exhibit creep when hot. These skins advantageously have the following characteristics:

- 15 - the thickness is between 0.6 and 1.1 mm
- the tensile strength (TS) is at least 5 MPa
- the elongation at break (EB) is at least 300%
- the aging after 500 h at 100°C, expressed by the variation in elongation, is at most 40%
- 20 - the aging after 250 h at 120°C, expressed by the variation in elongation at break, is at most 50%
- the aging after 250 h at 120°C, expressed by the variation in the tensile strength, is at most 10%
- the elongation after creep at 140°C under a load of 25 0.5 bar is at most 30%
- fogging, DIN 75201 (3 h at 100°C): no deposition (by measuring the migration of phthalates)
- abrasion resistance and abrasive wear resistance

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after 30 min: meets the standards

- gloss: meets the standards

- heat withstand (22h at 100°C): meets the standards.

5 [Examples]

Except when otherwise indicated, the compositions of the products (% of acrylate, and the like) and the compositions of the powders of the invention are by weight.

10 The following products were used:

LOTADER® 8900, an ethylene/methyl acrylate/glycidyl methacrylate (GMA) copolymer containing 28% acrylate and 7.8% GMA, with an MFI of 6;

LOTADER® 6660, an ethylene/ethyl acrylate/maleic anhydride (MAH) copolymer containing 27.5% acrylate and 2.9% MAH, with an MFI of 40;

LOTADER® 7500, an ethylene/ethyl acrylate/maleic anhydride (MAH) copolymer containing 20.0% acrylate and 3.0% MAH, with an MFI of 70;

20 **LOTADER® AX 8999**, an ethylene/butyl acrylate/glycidyl methacrylate (GMA) copolymer containing 28% acrylate and 1% GMA, with an MFI of 70;

XX 1275, a catalyst, dimethyltallowamine (DMTA) in the form of a 3% masterbatch in an ethylene/butyl acrylate/MAH copolymer containing 32% acrylate and 3% MAH, with an MFI of 7;

LUCALEN A3110M, an ethylene/butyl acrylate/acrylic acid copolymer containing 8% acrylate and 4% acrylic acid,

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with an MFI of 6-8 (190° 2.16 kg);

IRGANOX B 225, 1:1 IRGANOX 1010/IRGAFOS 168;

TACKIFYING RESIN, REGALITE R1125;

MM, a carbon black;

5 **MAGNESIUM STEARATE**, mixtures of 65% stearate salt and
25% palmitate salt;

AEROSIL R972 (from Degussa);

ACTIVE CARBON, 3S and CXV (from CECA).

The various constituents above were reduced to a
10 powder with a particle size of 200 µm by cryogenic milling.

The various compositions of the invention were prepared by blending the constituents in a powder blender. Skins were prepared by the slush molding technique. The mold was brought to a temperature of 250°C in an oven. The
15 mold, removed from the oven, was subsequently covered with an excess of powder of the composition used. After approximately 10 s, the unmelted powder is removed by turning over the mold. The mold is then again brought to 250°C in the oven for 3 min. The mold is subsequently
20 cooled in cold water. The skin is subsequently removed from the mold. The compositions and the properties are collated in the following table 1.

Examples 5 and 6

25 Example 5 is a black skin and example 6 is a gray skin. These examples give better performance than examples 1 and 4 in terms of abrasion, mechanical properties, toxicity (no dimethylsulfamine), better heat aging

resistance (antioxidants) and less odor (active carbon).

The manufacture of the powder is divided into various steps. This manufacture is identical for all the formulations.

- 5 1. Compounding of the formulation based on LOTADER 8900 (= A) and LOTADER 7500 (= B) (Example 5).

The following formulations A were compounded in a Leistritz twin-screw extruder with venting, at a temperature of 160°C, and formulations B were compounded in
10 a Leistritz twin-screw extruder with venting, at a temperature of 180°C.

Example 5 (black)	Formulation A (in parts)	Formulation B (in parts)
LOTADER 8900	96.0	-
LOTADER 7500	-	68
REGALITE R1125 resin	2.0	2.0
IRGAFOS 168	0.4	0.4
IRGANOX 1010	1.0	1.0
MM, carbon black	1.0	1.0
LUCALEN M 3110	-	28.0
Active carbon 3S	1.0	1.0
Active carbon CXV	1.0	1.0

- 15 2. Dry blend of the granules of the 2 components in defined proportions

The A and B granules were dry-blended with the A/B mass ratio = 1.575.

The formulations were then cryogenically ground into a powder having a particle size of 200 μm and then 2% of magnesium stearate and 0.6% of AEROSIL silica were added to the high-speed mixer.

The mold was treated at 100°C with a mold-release agent and heated at 120°C for 20 min. (Chem-Trend S.A. Mono Coat MC-708A) and taken up to a temperature of 250-300°C in an oven. Next, the mold removed from the oven was covered with an excess amount of powder of the composition used. After about 10 s, the unmelted powder was removed by turning the mold upside down. The mold was then heated again in the oven at 250-300°C for 1-5 min. The mold was then cooled in cold water. The skin was then removed from the mold.

The compositions and properties of the formulations of examples 5 and 6 are the following:

Compound	Example 5 (black) (in parts)	Example 6 (gray) (in parts)
LOTADER 8900	55.7	54.6
LOTADER 7500	26.3	26.3
LUCALEN M 3110	10.8	10.1
IRGANOX 1010	1	-
IRGAFOS 168	0.4	-
IRGANOX B225	-	1
REGALITE R1125 resin	2	2
TiO ₂		2.9
Active carbon 3S	1.0	1.0
Active carbon CXV	1.0	1.0
MM, carbon black	1	0.3
Addition by dry blending		
Magnesium stearate	2	2
AEROSIL R 972	0.6	0.6
Properties		
Tensile strength (MPa)	> 6	> 6
Elongation at break (%)	> 300	> 300
Creep 0.5 bar (min) 140°C	> 30	> 30
Variation in elongation at break after aging (250 h at 120°C) (%)	< 50	< 50
Variation in tensile strength after aging (250 h at 120°C) (%)	< 10	< 10
Fogging, DIN 75201 (3 h at 100°C)	No deposit	No deposit

TABLE 1

	Ex. 1	Ex. 2	Ex. 3	Ex. 4	Ex. 5	Ex. 6
LOTADER 8900	34.8		34.8	24.4	28.4	17.4
LOTADER 6600	63.2	18.8	63.2	49.9	51.6	41
LOTADER AX 8999		79.2		23.7		39.6
XX 1275	2	2	2	2		
Losses in g, Taber test	0.0075/ 0.018				0.0196	
Mean losses in g, Taber test	4.6					
Standard deviation of the losses	4.0					
Creep resistance at 120°C without load with 3 min of post-smoothing at 250°C			Holds 30 min	Holds 30 min		Holds 30 min

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4. The composition as claimed in claim 2 or 3, in which the product (B) is advantageously an ethylene/alkyl (meth)acrylate/unsaturated epoxide copolymer which can contain up to 40% by weight of alkyl (meth)acrylate and up to 10% by weight of unsaturated epoxide.

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(54) Title: CROSSLINKABLE COMPOSITIONS OF FUNCTIONALISED POLYOLEFIN POWDERS

(54) Titre: COMPOSITIONS RETICULABLES DE POUDRES DE POLYOLÉFINES FONCTIONNALISÉES

(57) Abstract: The invention concerns a crosslinkable composition of functionalised polyolefin powder comprising a functionalised polyolefin (A) having an MFI of at least 20 (190 °C 2.16 kg), a product (B) having a function for crosslinking (A), the composition having a grain size distribution between 100 and 400 µm. Said composition is useful for slush moulding, for thermoforming sheets or injection on an insert.

(57) Abrégé: La présente invention est une composition réticulable de poudre de polyoléfine fonctionnalisée et comprenant: une polyoléfine fonctionnalisée (A) ayant un MFI d'au moins 20 (190 °C 2.16 kg), un produit (B) ayant pour fonction de réticuler (A), la composition ayant une granulométrie entre 100 et 400 µm. Elle est utile dans le procédé de slush molding, en thermoformage de feuilles ou encore en injection sur un insert.

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Declaration and Power of Attorney United States Patent Application

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Sole & Joint Inventors
Convention & Non-convention
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As a below named inventor, I hereby declare that

My residence, post office address and citizenship are as stated below next to my name

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **CROSSLINKABLE COMPOSITIONS FORMED FROM**

FUNCTIONALIZED POLYOLEFIN POWDERS

(check one) ☐ is attached hereto.

☒ was filed as U.S. Application No. _____ on 8 March 2002 and (if applicable) was amended on 8 March 2002

☒ was filed as PCT International Application No. PCT/FR00/02441 on September 5, 2000 and (if applicable) was amended under PCT Article 34 on _____.

I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) or §365(b) of any foreign and PCT application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America listed in this Declaration. I have also identified below any foreign application for patent or inventor's certificate or PCT international application having a filing date before that of the application(s) on which priority is claimed:

Foreign/PCT Application No	Country	Filing Date	Priority Claimed? (yes/no)
99/11353	FRANCE	September 10, 1999	YES

I hereby claim the benefit under Title 35, United States Code, §120 or §365(c) of any United States application and PCT international application designating the United States of America listed in this Declaration and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application or PCT international application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

U.S. Application No	Filing Date	Status (patented/pending/abandoned?)

The duty is acknowledged for the Preliminary Amendment, which is hereby incorporated by reference as part of the original disclosure.

I hereby claim priority benefits under Title 35 United States Code §119(e) of any U.S. provisional application(s) listed below

U.S. Provisional Application No	Filing Date

I hereby appoint the following attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: Robert G. Weilacher (20,531), Herbert M. Hanegan (25,682), Dale Lischer (28,438), Frederick F. Calvetti (28,557), J. Rodgers Lunsford, III (29,405), Michael A. Makuch (32,263), Dennis C. Rodgers (32,936), Mary A. Montebello (33,021), Eric J. Hanson (44,738), Patrick R. Delaney (45,338), Brandon S. Boss (46,567), and Brett L. Nelson (48,119).

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Additional inventors and/or prior applications are listed in attached Supplemental Sheet(s).

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